Appendix F

Estimated Mass of PCBs Removed for Dredging Alternatives 2 and 3

Summary of PCB Mass Removed for Dredging Alternatives 2A through 3B

Sediment samples were collected from the project area at 2-foot intervals and were analyzed for PCB concentrations (Altech, 2003). Five dredging alternatives were evaluated (Alternatives 2A through 3B). The project area (dredging area) was divided into three sections for evaluating each dredging alternative. A description of how the estimated mass of PCBs removed for each dredging alternative was calculated is described below.

1. For each Section (1 through 3) and dredging Alternative (2A through 3B) PCB concentrations for each section of the project area were plotted in cross-section.
2. The proposed dredging elevations for each alternative were plotted on the PCB cross-sections.
3. PCB concentrations were recorded into and Excel spreadsheet from the dredging elevation to the top of sediment.
4. The average PCB concentrations for each section was computed by summing the PCB concentrations removed for each section and dividing by the total number of samples with analytical results. This was called the average PCB concentration for all sediment removed.
5. This average concentration was multiplied by the estimated volume of sediment removed, a summary of volume calculations is provided in Appendix G, and an estimate of the average bulk sediment density (dry) to determine the mass of PCB removed for each section.
6. The mass of PCB removed for each section of each alternative was summed up and rounded to the nearest 100 lbs to determine the estimated mass of PCBs removed for each dredging scenario.

Source: USACE & WDNR. April 7, 2004. Kinnickinnic River, Wisconsin - Milwaukee Estuary of Concern - Deepening/Remediation Concept Design Documentation Report. Appendix F.

Summary of PCB Mass Removed
Dredging Alternatives 2A through 3B
Kinnickinnic River
Milwaukee, Wisconsin

Dredging Scenario	Section 1 PCB Mass (lb)	Section 2 PCB Mass (lb)	Section 3 PCB Mass (lb)	Total PCB Mass (lb) [1]
Alternative 2A	188	327	822	1300
Alternative 2B	124	203	229	600
Alternative 2C	143	239	333	700
Alternative 3A	156	311	705	1200
Alternative 3B	129	266	574	1000

Notes:
1: Total PCB mass rounded to the nearest 100 lb

Alternative 2A - Section 1
PCB Concentrations (mg/kg) Removed down to 557 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0201	KK0202	KK0203	KK0203D	KK0204
Top of Sediment					
		2.75			
		0.72	0.79		1.40
		7.60	0.95	0.42	1.10
	2.00	9.28	1.74	2.47	6.28
	0.85	6.36	2.68	3.19	3.35
	0.00	3.13	15.74	9.52	4.36
	0.77	2.73	6.28	2.90	1.40
Dredging Extent	0.00	2.10	1.92	2.40	2.15
Average PCB Conc by Boring (mg/kg)	0.72	4.33	4.30	3.48	2.86

Average PCB Conc of All Sediment Removed	3.31	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	1,134,950	ft^3		
Estimated Mass of PCB Removed	85	kg PCBs		
Estimated Mass of PCB Removed	188	lb PCBs		

Alternative 2A - Section 2
PCB Concentrations (mg/kg) Removed down to 557 to 553 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0205	KK0206	KK0207	KK0207R	KK0208
Top of Sediment					
		1.00			
	1.30	0.90			
	1.40	1.70			ns
	8.26	6.89			0.72
	7.90	3.51	ns	1.90	ns
	12.50	3.06	ns	ns	5.48
	2.91	3.46	7.00	1.40	5.67
	2.10	0.87	4.25	1.10	6.42
Dredging Extent	0.53	0.94	3.11	2.10	3.91
Average PCB Conc by Boring (mg/kg)	4.61	2.48	4.79	1.63	4.44

Average PCB Conc of All Sediment Removed	3.53	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	1,855,386	ft^3		
Estimated Mass of PCB Removed	148	kg PCBs		
Estimated Mass of PCB Removed	327	lb PCBs		

Alternative 2A - Section 3
PCB Concentrations (mg/kg) Removed down to 553 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0209	KK0210	KK0211	KK0212	KK0213	KK0214
Top of Sediment	2.33					
	1.82					
	2.74					
	5.11				3.90	
	16.00	0.35		4.55	2.96	
	35.50	1.70	6.10	2.20	2.59	
	21.40	4.54	15.30	6.67	5.16	ns
	24.20	16.80	8.90	5.16	10.50	1.40
	ns	8.20	15.30	3.53	7.87	1.93
	ns	ns	5.23	12.86	ns	1.00
Dredging Extent	1.10	2.73	12.10	5.69	ns	0.85
Average PCB Conc by Boring (mg/kg)	12.24	5.72	10.49	5.81	5.50	1.30

Average PCB Conc of All Sediment Removed	7.53	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	2,187,592	ft^3		
Estimated Mass of PCB Removed	374	kg PCBs		
Estimated Mass of PCB Removed	822	lb PCBs		

Alternative 2B - Section 1
PCB Concentrations (mg/kg) Removed down to 563.5 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0201	KK0202	KK0203	KK0203D	KK0204
Top of Sediment					
		2.75	0.79		
		0.72	0.95	0.42	1.40
		7.60	1.74	2.47	1.10
	2.00	9.28	2.68	3.19	6.28
Dredging Extent	0.85	6.36	15.74	9.52	3.35
Average PCB Conc by Boring (mg/kg)	1.43	5.34	4.38	3.90	3.03

Average PCB Conc of All Sediment Removed	3.96	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	628,167	ft^3		
Estimated Mass of PCB Removed	56	kg PCBs		
Estimated Mass of PCB Removed	124	lb PCBs		

Alternative 2B - Section 2
PCB Concentrations (mg/kg) Removed down to 563.5 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0205	KK0206	KK0207	KK0207R	KK0208
Top of Sediment					
	1.30	1.00			
	1.40	0.90			
	8.26	1.70			ns
	7.90	6.89			0.72
	12.50	3.51	ns	1.90	ns
Dredging Extent	2.91	3.06	ns	ns	5.48
Average PCB Conc by Boring (mg/kg)	5.71	2.84	ns	1.90	3.10

Average PCB Conc of All Sediment Removed	3.96	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	1,024,935	ft^3		
Estimated Mass of PCB Removed	92	kg PCBs		
Estimated Mass of PCB Removed	203	lb PCBs		

Alternative 2B - Section 3
PCB Concentrations (mg/kg) Removed down to 563.5 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0209	KK0210	KK0211	KK0212	KK0213	KK0214
Top of Sediment						
	2.33					
	1.82		6.10	4.55		
	2.74		15.30	2.20	3.90	
	5.11	0.35	8.90	6.67	2.96	ns
Dredging Extent	16.00	1.70	15.30	5.16	2.59	1.40
Average PCB Conc by Boring (mg/kg)	5.60	1.03	11.40	4.65	3.15	1.40

Average PCB Conc of All Sediment Removed	5.53	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	830,679	ft^3		
Estimated Mass of PCB Removed	104	kg PCBs		
Estimated Mass of PCB Removed	229	lb PCBs		

Alternative 2C - Section 1
PCB Concentrations (mg/kg) Removed down to 562 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0201	KK0202	KK0203	KK0203D	KK0204
Top of Sediment					
		2.75	0.79		
		0.72	0.95	0.42	1.40
		7.60	1.74	2.47	1.10
	2.00	9.28	2.68	3.19	6.28
	0.85	6.36	15.74	9.52	3.35
Dredging Extent	0.00	3.13	6.28	2.90	4.36
Average PCB Conc by Boring (mg/kg)	0.95	4.97	4.70	3.70	3.30

Average PCB Conc of All Sediment Removed	3.83	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	745,117	ft^3		
Estimated Mass of PCB Removed	65	kg PCBs		
Estimated Mass of PCB Removed	143	lb PCBs		

Alternative 2C - Section 2
PCB Concentrations (mg/kg) Removed down to 562 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0205	KK0206	KK0207	KK0207R	KK0208
Top of Sediment					
		1.00			
	1.30	0.90			
	1.40	1.70			ns
	8.26	6.89			0.72
	7.90	3.51	ns	1.90	ns
	12.50	3.06	ns	ns	5.48
Dredging Extent	2.91	3.46	7.00	1.40	5.67
Average PCB Conc by Boring (mg/kg)	5.71	2.93	7.00	1.65	3.96

Average PCB Conc of All Sediment Removed	4.05	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	1,184,418	ft^3		
Estimated Mass of PCB Removed	109	kg PCBs		
Estimated Mass of PCB Removed	239	lb PCBs		

Alternative 2C - Section 3
PCB Concentrations (mg/kg) Removed down to 562 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0209	KK0210	KK0211	KK0212	KK0213	KK0214
Top of Sediment						
	2.33					
	1.82			4.55		
	2.74		6.10	2.20	3.90	
	5.11	0.35	15.30	6.67	2.96	ns
	16.00	1.70	8.90	5.16	2.59	1.40
Dredging Extent	35.50	4.54	15.30	3.53	5.16	1.93
Average PCB Conc by Boring (mg/kg)	10.58	2.20	11.40	4.42	3.65	1.67

Average PCB Conc of All Sediment Removed	6.49	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	1,027,343	ft^3		
Estimated Mass of PCB Removed	151	kg PCBs		
Estimated Mass of PCB Removed	333	lb PCBs		

Alternative 3A - Section 1
PCB Concentrations (mg/kg) Removed down to 557 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0201	KK0202	KK0203	KK0203D	KK0204
Top of Sediment					
		2.75			
		0.72	0.79		1.40
		7.60	0.95	0.42	1.10
	2.00	9.28	1.74	2.47	6.28
	0.85	6.36	2.68	3.19	3.35
	0.00	3.13	15.74	9.52	4.36
	0.77	2.73	6.28	2.90	1.40
Dredging Extent	0.00	2.10	1.92	2.40	2.15
Average PCB Conc by Boring (mg/kg)	0.72	4.33	4.30	3.48	2.86

Average PCB Conc of All Sediment Removed	3.31	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	944,976	ft^3		
Estimated Mass of PCB Removed	71	kg PCBs		
Estimated Mass of PCB Removed	156	lb PCBs		

Alternative 3A - Section 2
PCB Concentrations (mg/kg) Removed down to 557 to 553 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0205	KK0206	KK0207	KK0207R	KK0208
Top of Sediment					
		1.00			
	1.30	0.90			
	1.40	1.70			ns
	8.26	6.89			0.72
	7.90	3.51	ns	1.90	ns
	12.50	3.06	ns	ns	5.48
	2.91	3.46	7.00	1.40	5.67
	2.10	0.87	4.25	1.10	6.42
Dredging Extent	0.53	0.94	3.11	2.10	3.91
Average PCB Conc by Boring (mg/kg)	4.61	2.48	4.79	1.63	4.44

Average PCB Conc of All Sediment Removed	3.53	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	1,765,251	ft^3		
Estimated Mass of PCB Removed	141	kg PCBs		
Estimated Mass of PCB Removed	311	lb PCBs		

Alternative 3A - Section 3
PCB Concentrations (mg/kg) Removed down to 553 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0209	KK0210	KK0211	KK0212	KK0213	KK0214
Top of Sediment	2.33					
	1.82					
	2.74					
	5.11				3.90	
	16.00	0.35		4.55	2.96	
	35.50	1.70	6.10	2.20	2.59	
	21.40	4.54	15.30	6.67	5.16	ns
	24.20	16.80	8.90	5.16	10.50	1.40
	ns	8.20	15.30	3.53	7.87	1.93
	ns	ns	5.23	12.86	ns	1.00
Dredging Extent	1.10	2.73	12.10	5.69	ns	0.85
Average PCB Conc by Boring (mg/kg)	12.24	5.72	10.49	5.81	5.50	1.30

Average PCB Conc of All Sediment Removed	7.53	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	1,874,496	ft^3		
Estimated Mass of PCB Removed	320	kg PCBs		
Estimated Mass of PCB Removed	705	lb PCBs		

Alternative 3B - Section 1
PCB Concentrations (mg/kg) Removed down to 561 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0201	KK0202	KK0203	KK0203D	KK0204
Top of Sediment					
		2.75	0.79		
		0.72	0.95	0.42	
		7.60	1.74	2.47	1.40
	2.00	9.28	2.68	3.19	1.10
	0.85	6.36	15.74	9.52	6.28
	0.00	3.13	6.28	2.90	3.35
Dredging Extent	0.77	2.73	1.92	2.40	4.36
Average PCB Conc by Boring (mg/kg)	0.91	4.65	4.30	3.48	3.30

Average PCB Conc of All Sediment Removed	3.58	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	722,771	ft^3		
Estimated Mass of PCB Removed	59	kg PCBs		
Estimated Mass of PCB Removed	129	lb PCBs		

Alternative 3B - Section 2
PCB Concentrations (mg/kg) Removed down to 561 to 557 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0205	KK0206	KK0207	KK0207R	KK0208
Top of Sediment					
		1.00			
	1.30	0.90			ns
	1.40	1.70			0.72
	8.26	6.89		1.90	ns
	7.90	3.51	ns	ns	5.48
	12.50	3.06	ns	1.40	5.67
	2.91	3.46	7.00	1.10	6.42
Dredging Extent	2.10	0.87	4.25	2.10	3.91
Average PCB Conc by Boring (mg/kg)	5.20	2.67	5.63	1.63	4.44

Average PCB Conc of All Sediment Removed	3.76	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	1,419,097	ft^3		
Estimated Mass of PCB Removed	121	kg PCBs		
Estimated Mass of PCB Removed	266	lb PCBs		

Alternative 3B - Section 3
PCB Concentrations (mg/kg) Removed down to 557 feet msl
Kinnickinnic River
Milwaukee, Wisconsin

	KK0209	KK0210	KK0211	KK0212	KK0213	KK0214
Top of Sediment						
	2.33					
	1.82			4.55		
	2.74		6.10	2.20	3.90	
	5.11	0.35	15.30	6.67	2.96	ns
	16.00	1.70	8.90	5.16	2.59	1.40
	35.50	4.54	15.30	3.53	5.16	1.93
	21.40	16.80	5.23	12.86	10.50	1.00
Dredging Extent	24.20	8.20	12.10	5.69	7.87	0.85
Average PCB Conc by Boring (mg/kg)	13.64	6.32	10.49	5.81	5.50	1.30

Average PCB Conc of All Sediment Removed	7.85	mg/kg	**Bulk Sediment Density (dry)**	50 lb/ft^3
Volume of Sediment Removed	1,466,658	ft^3		
Estimated Mass of PCB Removed	261	kg PCBs		
Estimated Mass of PCB Removed	574	lb PCBs		